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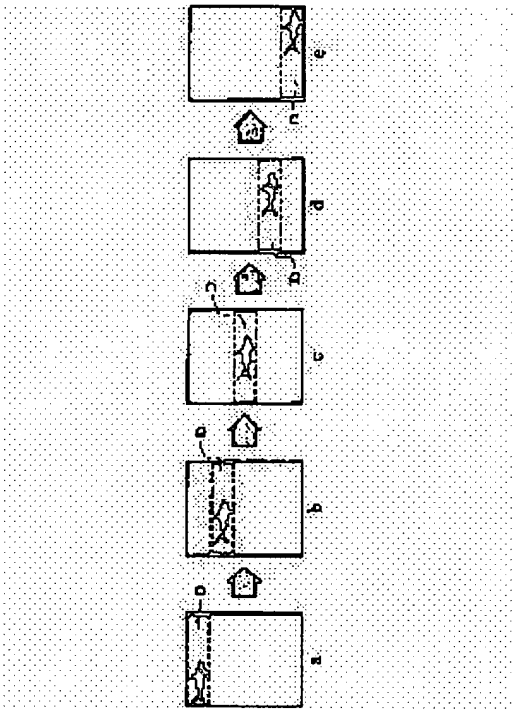
(54) DRIVING METHOD FOR DISPLAY DEVICE, DISPLAY DEVICE AND ELECTRONIC INSTRUMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To make a display have interest and creativity while keeping a low power consumption property by changing at least one of the position, the area or the display content of a partial area to be a display state at certain time intervals.

SOLUTION: In the whole screen enclosed with a full line, the inner side D of a broken line indicates a display state and the outer side of the line indicates a non-display state. Then, a display is successively changed over from (a) to (b), (b) to (c), (c) to (d), (d) to (e) of the figure at certain time intervals. These changeover time intervals may be constant or may be changed properly. In this case, a display content (pattern) is changed over so that a fish is successively moved from the left side of a screen to the right side of the screen. Moreover, it may be performed to change over only the number of display rows or the display content by fixing the row of the end part of the area of the partial display area D at a prescribed row. That is, it is also acceptable to successively change the row of the row end of the lower side (the lowermost scanning line of D) while making the row end of the upper side of the area D (the uppermost scanning line of D) always a fixed row.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the actuation approach of the display of the dot-matrix mold which makes only some fields of a screen a display condition and changes other fields into a non-display condition, a display, and the electronic equipment using it.
[0002]
[Description of the Prior Art] The number of display dots is increasing the display used for pocket electronic equipment, such as a cellular phone, every year so that more information can be displayed, and the power consumption by the display has also been increasing in connection with it. Since the power source of pocket electronic equipment is a cell, it is called for strongly that it is a low power as a battery life is made for a long time.
[0003] Therefore, although a full screen is made into a display condition in a display with many display dots when required, the method of making only some fields of a display panel into a display condition at the time, so that a necessary minimum display can be performed, changing other fields into a non-display condition, and reducing power consumption is usually beginning to be examined.
[0004] Arranging some dozens of - marks called an icon to the outside of the display which consists of dot matrices, by the normal state, the display which made only the icon part the display condition and aimed at power consumption reduction by making a dot-matrix part into a non-display condition has already existed in the commercial scene. However, since the content which can carry out sector display will already be fixed in the phase of a display panel, it is the display which lacked in versatility deficiently at enjoyment.
[0005] In the conventional dot-matrix mold display, although there are many things with the function which can control a display / un-displaying, the thing with the function which makes a display condition only some fields in a dot-matrix screen, and changes other parts into a non-display condition is not put in practical use yet. [of a full screen] As an approach of realizing the function which can make a display condition some fields of a liquid crystal display panel, and can change other fields into a non-display condition, the example 1 and JP,7-281632,A of JP,6-95621,A are proposed. Both these two conventional examples have described the case where a liquid crystal display panel is a simple matrix method.
[0006] The example of JP,6-95621,A is explained below using drawing 8 . Drawing 8 is the block diagram of the liquid crystal display of this example. Block 31 is a liquid crystal display panel (LCD panel), at spacing which is several micrometers, the substrate in which two or more scan electrodes were formed, and the substrate in which two or more signal electrodes were formed counter, and are arranged, and liquid crystal is enclosed with the gap. Block 34 is a Y driver which outputs a selection electrical potential difference and a non-choosing electrical potential difference, and drives a scan electrode, and block 35 is an X driver which outputs a signal level based on an indicative data Dn, and drives a signal electrode. Two or more voltage levels required for actuation of liquid crystal are formed in the driver voltage formation circuit of block 33, and are impressed to the liquid crystal display panel 31 via the X driver 35 or the Y driver 34. Block 37 is a scan control circuit which controls the number of scan electrodes which should be scanned. Block 32 is a LCD controller which forms a signal required for those circuits. Block 36 is the power supply source of the above circuit, and generates the electrical potential difference of +5V and -24V. A selection electrical potential difference is impressed one line at a time to a scan electrode one by one, and a non-choosing electrical potential difference is impressed to other lines. Sequential impression of ON / signal level which follows off of each pixel of the line chosen as the signal electrode is carried out.
[0007] A clock for the clock for a scan signal transfer which FRM shifts FRM to a screen scan start signal, and shifts CLY here for every clock, and CLX to latch the indicative data to which the clock for a transfer of an indicative data Dn and LP were transmitted to X driver for every line, and PD are the control signals for sector display.
[0008] This example has described the case of the upper half of them (D1) as the case where a sector display field is a left half screen (D1, D2), further. The case where a sector display field is a left half screen first is explained. The

number of pixels of 1 end of a road is set to 640. Before shifting to the sector display condition of a left half screen, all the pixels for one line write off data in X driver. After that, a LCD controller transmits only the indicative data for 320 pixels of 1 in all ends of a road to it while it doubles the period of the clock CLX for an indicative-data transfer and reduces by half the number of clocks within 1 selection period. Since the circuit which memorizes the indicative data for one line is built in X driver, even if there is no data transfer for 320 pixels of a right half screen, the right half of X driver continues memorizing the off data transmitted previously, and the output in the right half of X driver continues outputting the signal level which turns off a display. In this way, a right half screen can be made into an OFF display condition. The power consumption of a display decreases a little compared with the case of a full-screen-display condition because the one half of that the frequency of CLX is set to one half and a screen becomes an off display. In this case, it is more suitable to call it an off display condition rather than a right half screen is called non-display condition.

[0009] Next, a sector display field explains the case of only the upper half of the left half screens (D1). The number of scan electrodes is set to 400. Only a left half screen is made into a display condition by the approach first mentioned above. Then, the LCD controller 32 makes the sector display control signal PD "H" level, and makes a lower half a non-display condition. A full screen will be in a display condition by scanning all scan electrodes by 1/400 duty, when PD is "L" level, and when PD is "H" level, the bottom half screen (D2) of the remainder [screen / (D1) / Johan] in a display condition will be in the sector display condition of a non-display condition by scanning only the scan electrode in the upper half of a screen by 1/200 duty.

[0010] The change to 1/200 duty is performed by changing the period of the clock CLY for a scan signal transfer twice, and reducing by half the number of clocks within an one-frame period. Although the detail of the scan halt approach of the scan electrode of the bottom half screen in a sector display condition is not indicated, it is the approach the data transmitted to the 201st step from the 200th step of the shift register in Y driver are fixed to "L" level when PD is made into "H" level, judging from internal-circuitry drawing of the scan control circuit block 37, consequently the 201st - the 400th output of Y driver maintains a non-choosing voltage level.

[0011] ON/OFF state of a pixel are decided by actual value of the electrical potential difference which joins liquid crystal. The effective voltage which joins the liquid crystal of a bottom half screen becomes quite smaller than the effective voltage which joins the liquid crystal which is in the off display condition of upper right 1 / 4 screen, in order for a selection electrical potential difference not to join a scan electrode at all, consequently a bottom half screen is non-display thoroughly.

[0012] In addition, in the liquid crystal display panel of a simple matrix method, when changing display duty, setting-out modification of driver voltage or a bias ratio (driver voltage division ratio) is needed so that the contrast of a viewing area may not get worse. When setting duty to 1-/N, it is indicated in JP,57-57718,B that a desirable bias ratio is 1/(1+rootN). Moreover, in the case of N>>1, it is necessary to adjust driver voltage in proportion to rootN mostly. For example, if optimal driver voltage in the case of 1/400 duty is temporarily set to 28V and a rated bias ratio is made into 1/21, in the case of 1/200 duty, it is necessary to adjust driver voltage to 28V/root2**20V, and to adjust about 1/of bias ratios 15. Adjustment of such an electrical potential difference and a division ratio is made by the hard circuit means. When a half-screen's being non-display and driver voltage become low, the power consumption of a display decreases considerably compared with the case of a full-screen-display condition.

[0013] When a sector display line count is quite as small as - of about ten lines 20 line order, if duty is changed according to it, a desirable bias ratio will be set to one third or 1/4. Although the example has described JP,7-281632,A about the bias ratio in such a case, and the change means of driver voltage, the explanation is omitted here.

[0014]

[Problem(s) to be Solved by the Invention] The function itself which makes a display condition only some fields of the display panel which consisted of dot matrices, and changes other fields into a non-display condition by the approach which was mentioned above, and which is proposed until now becomes possible. However, since the field made to sector display will be limited only to setting out currently prepared in the hard circuit, while versatility will become very scarce, that the period of a clock must be changed or a bias ratio and driver voltage must be changed corresponding to the field which carries out sector display changes a location, area, etc. of a sector display field with a certain time interval, and it is accompanied by the fault that enjoyment cannot be given to a display.

[0015] Then, this invention aims at offering the actuation approach, the display, and electronic equipment of the display which can give enjoyment and originality to a display, after the field of sector display maintains the low-power nature by sector display using the high display of the versatility which can be set up in software.

[0016]

[Means for Solving the Problem] in order to solve the above-mentioned technical problem -- the display and its actuation approach of this invention -- the part in a screen -- said part which will be in a display condition in the display of the matrix type which has the function which makes a field a display condition and changes other fields into a non-display condition -- it is characterized by to change at least one of the location of a field, area, or the contents of a

display with a certain time interval. Enjoyment and originality can be given to a display after maintaining the low-power nature by sector display by doing so.
[0017] Moreover, the display and its actuation approach of this invention are characterized by said thing [that a field is a field corresponding to a part of scanning lines in all the scanning lines a part]. By making the field corresponding to the scanning line into sector display, power consumption can be reduced more nearly substantially than the time of a full screen display, and can also give the enjoyment and the originality at the time of sector display to remarkable extent.
[0018] Moreover, this invention is characterized by having the store circuit where the data in which the location in the screen of a forward Norikazu section field is shown are set up, and the pulse generator which specifies the timing which changes the data which this store circuit memorizes. Since the data (data, such as a display position and area) of a store circuit are changed to the timing which a pulse generator specifies and an indicating equipment can be driven based on this, according to the data of a store circuit, a display position and area can be freely changed into time series.
[0019] Moreover, said pulse generator consists a timing interval of a programmable timer, and it is characterized by coming to change the data memorized in said store circuit according to the pulse from this timer. According to the data set as a timer, the time interval from which sector display switches can be set up freely. Moreover, this invention is characterized by building in the circuit where X driver of the indicating equipment concerned memorizes the above indicative data by one screen. Since the count which transmits an indicative data can decrease from a system side remarkably to an indicating equipment by making the above indicative-data store circuit build in X driver by one screen in the display like a still picture, implementation of the indicating equipment with a sector display function of a low power is attained.
[0020] Moreover, this invention is characterized by the display concerned being a reflective mold or a transflective type liquid crystal display. Among displays, the liquid crystal display which does not use a back light is a low power most, and is further made into a low power by having a sector display function. Therefore, it is a low power most and enjoyment and originality can be given to a display upwards.
[0021] Moreover, this invention offers the electronic equipment possessing one of the above-mentioned displays. The electronic equipment which gave enjoyment and originality to the display after maintaining low-power nature by doing so can be offered.
[0022]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on a drawing.
[0023] (Example 1) Drawing 1 is drawing showing the example of the sector display condition in the display of this invention. The outside of a display condition and a broken line is [the inside D of a broken line] non-display among the full screens surrounded as the continuous line, and a display changes from c and c from b and b from a of drawing to e from d and d one by one with a certain time interval. Regularity is sufficient as this changing time interval, and it may be changed suitably. although the line count (number of scanning lines) of the sector display field D has changed only the location in this example, without changing -- a display position -- it may respond for changing and the number of display lines of a viewing area D (number of scanning lines) and the content of a display of a there (the content of an indicative data supplied to a signal line) may be changed simultaneously. In the example, the content of a display (pattern) is changed so that a fish may move to right-hand side one by one from screen left-hand side. Moreover, it is also good to fix the line of the field edge of the sector display field D to Sadayuki Tokoro, and to change the number of the display lines, or the content of a display. That is, upside **** (the best scanning line of D) of a broken line D always considers as a fixed line, and you may make it change the line (the lowest scanning line of D) of bottom **** one by one. For example, a sector display condition as shown in drawing 2 a, b, and c may be wedged in the middle of the change of a display, and may be displayed. Of course, bottom **** may be considered as immobilization, and sequential change of the upside **** may be carried out.
[0024] Although a full screen is occasionally made into a display condition, the display panel of this example is made into the condition which is the need of displaying only on some fields of a display panel like drawing 1 or drawing 2 , at the time of standby, and changes the location, the line count, or the content of a display of the sector display field D.
[0025] (Explanation of circuitry) The configuration of a display and the example of a circuit means which make possible sector display shown in the example 1 below are explained. Drawing 3 is drawing having shown the example of a configuration of the display of this invention.
[0026] Block 1 is a liquid crystal display panel (LCD panel), and at spacing which is several micrometers, the substrate in which two or more scan electrodes (scanning line) were formed, and the substrate in which two or more signal electrodes (signal line) were formed counter, and are arranged, liquid crystal is enclosed with the gap, and it constitutes the display screen. The slash section D in the liquid crystal display panel 1 is a field which is carrying out sector display, and the other field is non-display.
[0027] A substrate is chosen from members, such as glass, a member of the light transmission nature of plastics, and a semi-conductor substrate, here. Moreover, liquid crystal is chosen from various liquid crystal, such as memory types,

such as a twist nematic mold, a super twist nematic mold, a strong dielectric mold, and a bistability nematic mold, giant-molecule distributed process input output equipment, a homeotropic orientation, and a type by which homogeneous orientation was carried out. As structure of a liquid crystal display panel, the liquid crystal display panel of the active-matrix mold in which the pixel electrode connected with the one terminal pair network mold switching element at it at the substrate side with which the signal line other than the simple matrix type of the above-mentioned structure is formed was formed, and the active-matrix mold which formed the scanning line and a signal line in one substrate in the shape of a matrix, and formed the pixel electrode connected with the transistor switched to each pixel by the scanning line at this is sufficient.

[0028] Moreover, under the reflective mold which does not need the light sources for lighting, such as a back light, or ordinary light, in order to harness the low-power nature in a sector display condition, although it can express as a light source astigmatism LGT, when dramatically dark, or only when restricted, it is desirable [a display mode] that it is the transflective type which displays by turning on the light source. In addition, as for the case of a transparency mold, in the case of a reflective mold, according to the class of liquid crystal, a polarizing plate is arranged [the outside of the substrate of the couple of a liquid crystal display panel] at a front-face and tooth-back side at a front-face side if needed.

[0029] Block 4 is a Y driver which impresses and drives a selection electrical potential difference and a non-choosing electrical potential difference to two or more scan electrodes, and block 5 is an X driver which impresses and drives the signal level according to the content of a display (indicative data) to a signal electrode. the driver voltage formation circuit of block 3 forms two or more voltage levels required for actuation of liquid crystal in response to supply of supply voltage from the power source 6 mentioned later -- the voltage level of these plurality is supplied to the X driver 5 or the Y driver 4. Each driver chooses a predetermined voltage level according to a timing signal or an indicative data from the supplied voltage levels, and impresses it to the signal electrode and scan electrode of the liquid crystal display panel 1. Block 2 is a LCD controller which forms the timing signals CLY, FRM, CLX, and LP required for those circuits, and an indicative data Dn and a control signal PDY, and is connected to the system bus 11 of the electronic equipment containing this liquid crystal display. Block 6 is a power source which is in the exterior of a liquid crystal display and is carrying out the electric power supply to each circuit of this above liquid crystal display. Supply voltage is set to 3V in this example. The content of each signal is explained to compensate for next drawing 4 or explanation of drawing 5 .

[0030] in addition -- although the controller 2 and the driver voltage formation circuit 3 are expressed here as an independent circuit block -- the driver IC chip of either 4 or 5 -- you may build -- the driver of both 4 and 5 -- together -- 1 -- it may chip-ize and you may constitute. If it is the active-matrix mold liquid crystal display panel by which the liquid crystal display panel 1 used one substrate as the semi-conductor substrate, and used the opposite substrate as the transparence substrate, the controller 2 besides the X driver 5 and the Y driver 4 and the driver voltage formation circuit 3 can also be formed into 1 chip to the above-mentioned semi-conductor substrate.

[0031] Drawing 4 is the block diagram showing some examples of the controller 2 of drawing 3 . By setting the location and area of a sector display field as the register in a controller 2, the applicant for this patent proposed previously the display which the sector display field D can set up in software (Japanese Patent Application No. No. 351024 [nine to], 10-27665). Then, it is the approach a non-display field access period stops thoroughly actuation unnecessary not only about drivers 4 and 5 or the controller 2 but the driver voltage formation circuit 3, without the proposed approach changing duty, driver voltage, a bias ratio, the X driver 5, the period of the shift clocks CLX and CLY for Y driver 4, etc. The driver voltage formation circuit 3 in this case needs to be what (electrical-potential-difference supply is maintainable by the capacitor) driver voltage level can hold to some extent, even if only the time amount of one-frame period extent suspends actuation like a charge pump circuit (circuit which changes the serial/parallel connection of two or more capacitors, and carries out pressure up of the voltage level). Drawing 4 adds a timer function and enables it to update the content of the register which has set up the location of the sector display field D with a certain time interval based on the approach proposed there.

[0032] Each block of drawing 4 is explained. 7 is the circuit block of a pulse generator with a timer function, and shows the timer which specifically carries out counting of the predetermined time, and carries out a pulse output to a register 8. For example, the screen scan start signal FRM for every one-frame period is counted, for example, the signal of one pulse is outputted to a register 8 every about 2 seconds. Since a timer consists of a PURISETTA bull counter which the time interval which carries out counting can program set as arbitration, presetting setting out of the counter is carried out according to the data into which the time interval of a pulse output was inputted through the bus 11. In addition, or this timer 7 does not take out a pulse signal periodically but it shortens a period gradually, lengthening, making it random, etc. can set up output spacing of a pulse signal freely by rewriting the presetting data of a PURISETTA bull counter in a short period.

[0033] 8 is a register as an about 8-bit store circuit equipped with the adder, and the information corresponding to the location and width of face of the sector display field D is initialized through a bus 11 there. For example, the

information corresponding to the display initial line (the maximum upper bed scanning-line number) of the sector display field D and the information corresponding to the width of face of the direction of a train of the sector display field D are respectively stored in the 6-8th bit at the 1-5th bit. The location of 32 kinds of sector display initial lines can be set up in the direction of a train by 1-5th bit a total of 5 bits, and the 32 scanning lines in a screen can be selectively assigned as a sector display initial line according to the bit value. Moreover, by 6-8th bit a total of 3 bits, the width of face of the sector display of the direction of a train can set up eight kinds, and can set up the number of scanning lines set up as a sector display field D from eight kinds of number of scanning lines according to a bit value. It is the value to which the set point of a register 8 makes a unit dozens of [a scanning-line number or not the value of the number itself but / several -] here.

[0034] A value predetermined whenever the above-mentioned pulse signal is sent from a timer 7 is added and updated, like drawing 1 , with time amount, the scanning line of the display initial line of the sector display field D changes, and is specified, the sector display field D shifts to the bottom (the direction of a train) one by one, and the set point of the 1-5th bit goes. Moreover, if a predetermined value is added to the set point of the 6-8th bit whenever the above-mentioned pulse signal is sent from a timer 7, and it is made to be updated, it is also possible to change the display width of face (display number of scanning lines) of the sector display field D of the direction of a train with the time interval of a pulse signal, and to go. Moreover, the method of presentation which does not update but adds a predetermined value only for the bit data of display width of face as immobilization according to arrival of a pulse signal is sufficient as the bit data of a display initial line.

[0035] Moreover, unlike the above-mentioned approach, the 2nd bit group (the 5-8th bit) which shows the 1st bit group (the 1-4th bit) which shows the scanning line of the display initial line of the sector display field D to a register 8, and a display termination line (the lowest edge scanning-line number) is prepared. The initial line and the information on display width of face on sector display are initialized through a bus 11 in each bit. Corresponding to the time interval of the above-mentioned pulse signal inputted from a timer 7, addition setting out of the predetermined value corresponding to each is carried out at the 1st bit group and/or the 2nd bit group, and it may be made to carry out sequential change of the condition of sector display with the time interval. Only one side of the 1st and 2nd bit group may be set as addition of a predetermined value the same with having stated previously according to arrival of the above-mentioned pulse signal.

[0036] Furthermore, although the above case explained adding according to the pulse signal from a timer 7, operations other than addition (subtraction, multiplication, division) may be used. Furthermore, it enables it to set the information on whether sector display is performed to some registers 8, and the validity/invalid of a sector display function may be made to be changed based on the setting out. Moreover, two or more sequences of registers are prepared beforehand, and you may enable it to set the value corresponding to the line by the side of initiation of the sector display section, and the line by the side of termination as each. Moreover, it is also possible to make the sector display field D into two or more places within a display panel, as the sector display field D where a register is differed in a screen in each two or more system successive installation **** is set up beforehand.

[0037] Thus, it can respond to the variation of various sector display by changing the output time interval of the pulse signal of the content of setting out of a register 8, or a timer 7 with the software by the side of the system of electronic equipment, and controlling a register 8 and a timer 7 through a bus 11.

[0038] 9 is a circuit block which controls sector display, and the counter is constituted as a subject. The timing signals CNT and PDY which control sector display based on the screen scan start signal FRM for every one-frame period sent out from a system side and the timing signal of the clock CLY for a scan signal transfer for every 1 scanning-line selection period, and the information value corresponding to the location and width of face of the sector display field D which were set as the register 8 are formed. Although CNT and PDY are H level regularly [in the case of a full screen display], in the case of a sector display condition, it is set to L level during H level and the selection period of a undisplayed line during the selection period of a sector display line.

[0039] 10 is an AND-circuit block which controls the signals Dn, CLX, and LP to the X driver 5. It is a clock for latching the indicative data to which the indicative data was transmitted for Dn and the clock for a transfer of an indicative data and LP were transmitted for CLX to X driver for every line. DnI, CLXI, and LPI are signals which become those radicals, and since CNT is H level regularly in the case of a full screen display, an AND circuit opens them and they are respectively sent out to X driver as it is as Dn, CLX, and an LP. Although it is H level while CNT performs data transfer of a line which carries out sector display in the case of a sector display condition, other periods serve as L level, fix Dn, CLX, and LP to L level, and stop unnecessary data transfer. Even if it does not stop data transfer so that it may mention later, the sector display function itself is possible, but since and comparatively big power is consumed, unnecessary data transfer has the stopped desirable direction in respect of power consumption reduction. [data transfer] [comparatively] In addition, although Dn is shown as wiring of one, i.e., a 1 bit-serial transfer, by a diagram for brief-izing, it may be made to use with a bus 11 in common, for example, an indicative data may be transmitted by 8 bit parallel etc.

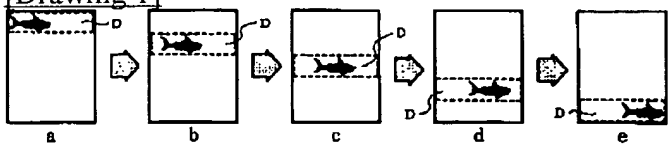
[0040] Drawing 5 is the example of the timing chart showing actuation of a circuit block of drawing 4 . A display panel is based on the simple matrix method of line sequential actuation with which sequential selection of the scan electrode (scanning line) is made one line at a time, and has made 200 lines the line count which can be displayed. The period before time of day t1 is in a full-screen-display condition, and it is an example in the case of being in the sector display condition that even - of 1st line the 40th line was displayed in the one-frame period after t1.
[0041] In a sector display condition, the period T when the line which carries out sector display of the PDY is chosen is H level, simultaneous selection of two or more is made individually one by one at a scan electrode, and a selection electrical potential difference (a selection electrical potential difference is impressed to a selection period) is impressed one by one per two or more. On the other hand, PDY serves as L level at the period equivalent to the selection period of a undisplayed line (scan electrode of a non-display field). If PDY is set to L level, the full power of the Y driver 4 serves as a non-choosing voltage level, and since a selection electrical potential difference is not impressed to the scan electrode of a undisplayed line during an one-frame period as a result, the screen area equivalent to the scan electrode will be in a non-display condition. Thus, the sector display function itself becomes possible only by stopping impression of the selection electrical potential difference to a undisplayed line, and power consumption is also reduced considerably. However, PDY is desirable between L level in respect of power consumption reduction of the direction which also suspended actuation of the driver voltage formation circuit 3.
[0042] While outputting the driver voltage corresponding to the display of a certain line as which the X driver 5 is chosen in the case of the dot-matrix mold display panel (a passive matrix and a active matrix are included), it is necessary to perform data transfer to the store circuit (SRAM and shift register) of X driver of the indicative data of the line chosen as a degree. Therefore, CNT serves as a signal which precedes only 1 horizontal-scanning period from PDY. Moreover, in the case of drawing 5 , as for the X driver 5, PDY will hold the indicative data of the 40th line to the store circuit of X driver between L level, and the driver voltage of the 40th line will continue being outputted, but during the period, since a selection electrical potential difference is not impressed to a scan electrode, it is not displayed.
[0043] In addition, when a display panel is an active-matrix method, each pixel continues holding with capacity the electrical potential difference on which the non-choosing period was impressed to the selection period before it. For this reason, when it shifts to a sector display condition from a full-screen-display condition, only the one-frame period of the beginning at the time of changing a display position, a screen product (display width of face), etc. of the sector display field D in the state of sector display also needs to give a selection electrical potential difference to the scanning line of a undisplayed line, and needs to write OFF state voltage in a pixel through a signal line. Therefore, as for drawing 4 and drawing 5 , some modification is needed. For example, in drawing 5 , PDY serves as one-frame period H level, also chooses the scanning line of a non-display field, the one-frame period which comes immediately after t1 writes OFF state voltage in the pixel of a non-display field from X driver, and, as for the selection period of H level and a non-display field, only in a period T, PDY serves as [PDY] L level from the next frame period.
[0044] The above is explanation about the example of a circuit which realizes a sector display function. Since the period of the clock CLY for a scan signal transfer is not changed in a sector display condition, the time amount which impresses a selection electrical potential difference to each scanning line of a viewing area is the same as the time of a full screen display. Therefore, there is no need of changing a bias ratio and a selection electrical potential difference. In addition, although CLY has the stopped one preferably in the place which can be stopped, since sector display is possible and the effect on power consumption is also small even if it does not stop, it is not necessary to stop.
[0045]

* NOTICES *

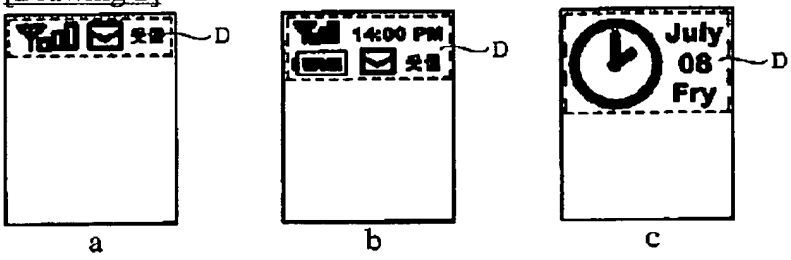
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

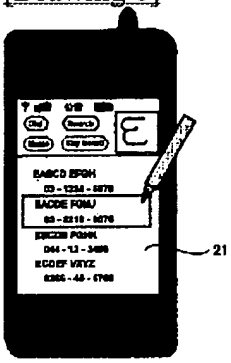
[Drawing 1]



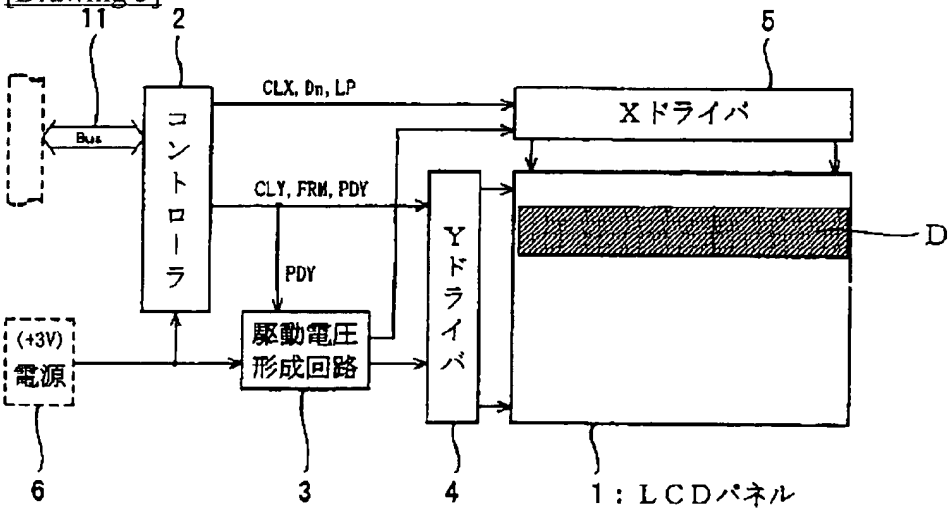
[Drawing 2]



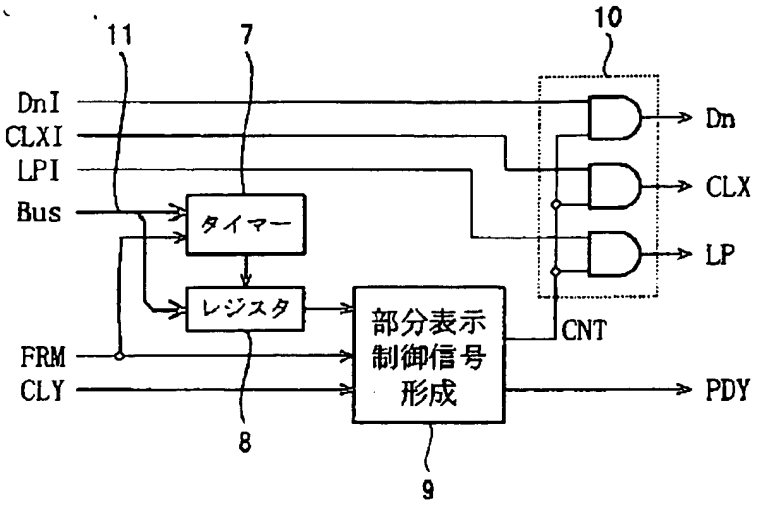
[Drawing 6]



[Drawing 3]

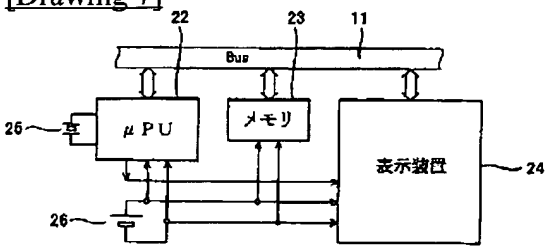


[Drawing 4]

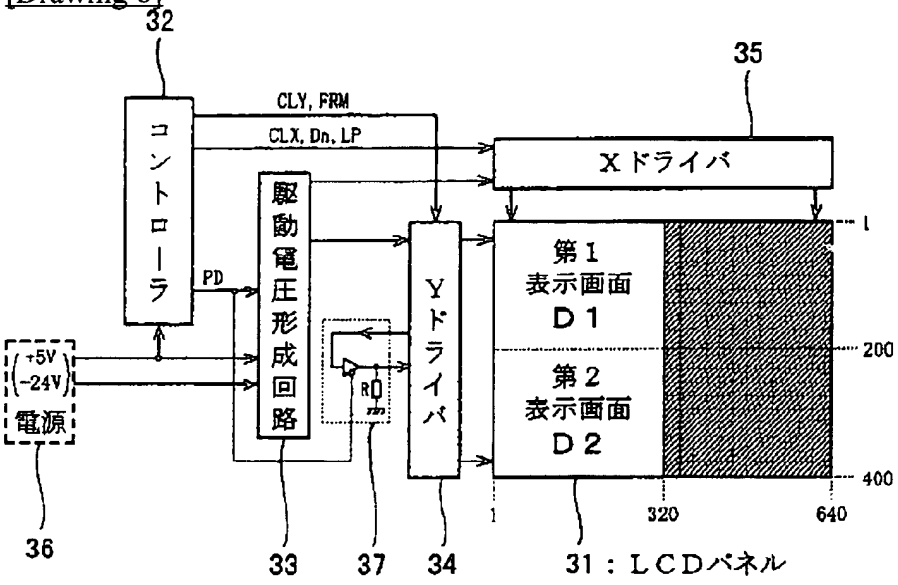


controller 2

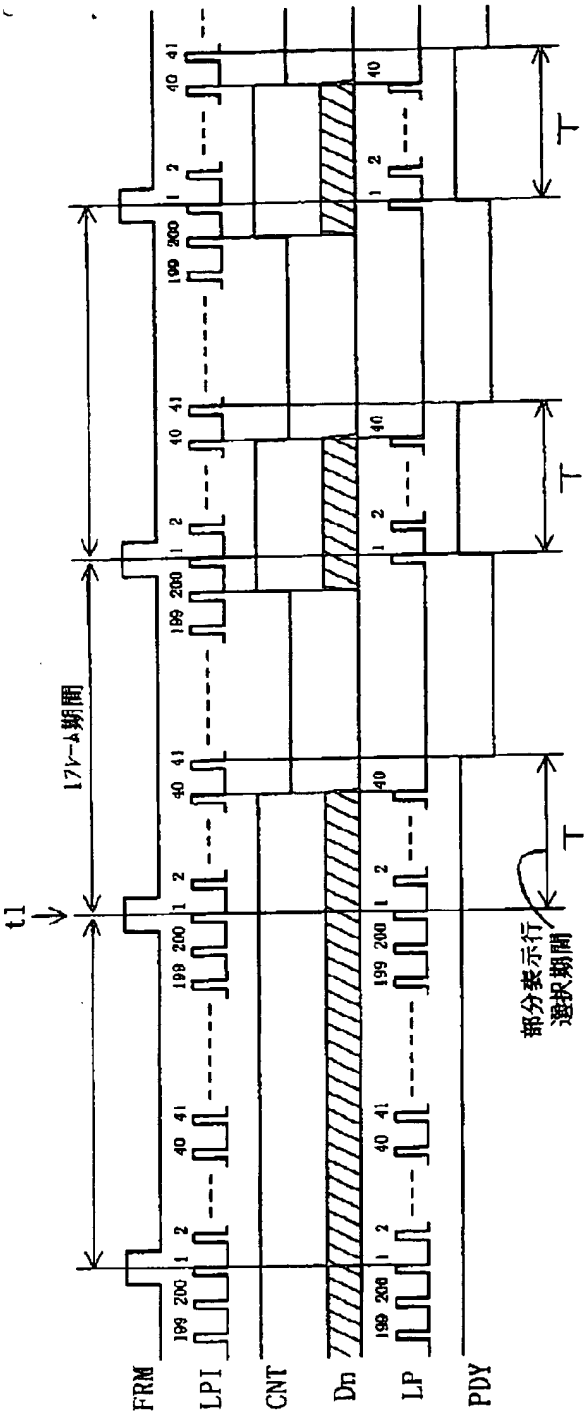
[Drawing 7]



[Drawing 8]



[Drawing 5]



[Translation done.]